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ELECTRONICS

BACKGROUND, PLANS FOR FRENCH SOFTWARE INDUSTRY OUTLINED

Paris PARADOXES in French Spring 83 pp 33-43

[Article by Maurice Allegre, Director of Scientific and Technological Development and Innovation: "The Software Battle"]

[Text] It would be... paradoxical to say the least not to recall the importance of data-processing at the beginning of an article written for this magazine. Our very title, "The Software Battle," is an indication of the expansion now taking place in this field, although the concept of software was unknown only 25 years ago.*

Data processing--whose major characteristic is software--is important in many respects: in helping the human brain by making it possible to process an ever larger number of data within an ever decreasing period of time, data processing has become an indispensable tool: for the research scientist in carrying out his experiments and computing his results; for the manager in defining company orientations and controlling its development; not to mention the politician wishing to analyze voters' opinions.

Software is increasingly important as it penetrates the most varied sectors: washing machine programming software, carburization control software in so-called "electronic injection" vehicles, chess game or star war software, all these are as many surprising examples. More traditional and often less well known, the example of telephone switchboards is also striking: controlled by a computer, these machines require programs consisting of several hundreds of thousands of instructions to detect calls, establish connections throughout the network, manage billing, and provide system operation and maintenance functions.

This arrival in force of software in sectors as varied as these is due to the fantastic progress accomplished in the field of electronic components, with the appearance of microprocessors and the "fourfold reduction of integrated circuits every decade." To summarize, we can say that every 10 years the circuits used for a given function become 10 times smaller, 10 times less expensive, 10 times more efficient and 10 times more reliable.

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* "Logiciel" is the translation of the English word "software"; use of this word became official in France some 10 years ago under the impulse of the Delegation to Data Processing.

As an indirect consequence of this evolution, the cost of software, corresponding to intellectual services performed, represents an ever increasing proportion of the total cost of a system, compared with the cost of hardware. For the same reason, the software accumulated by the user as years go by represents a heavy investment for him, an investment which he will be most careful to preserve should he subsequently decide to change his hardware; this is the well-known problem of compatibility, of program "portability" from one type of hardware to another.

Speaking of a "battle" implies that something is at stake. The stakes are many:

- In economic terms, first, what is at stake is to maintain France's position in the world, in the data-processing industry proper as well as in all industrial and tertiary sectors: the introduction of software into consumer goods, durable goods and industrial processes (what is now called "productics"), in data processing, transfer and storage (office automation, data communications) is unavoidable and it is a prerequisite to the competitiveness of industry and services as a whole.

- There are also stakes in terms of technological independence. As early as 1967, France launched a "Computer Plan" which enabled our country to acquire (hardware and software) expertise in mputer technology, the strategic (in all meanings of the word) importance of which had been recognized.

- Finally, there is a cultural stake, especially because of the strong development of data banks and bases and increased consultation possibilities through telecommunications networks. Because of its close synergy with telecommunications (data communications), data processing keeps making stronger inroads into all economic, sociological and cultural fields.

In view of such stakes, the authors of the French success--the data-processing consulting companies (SSCI), the manufacturers and the authorities--must take into account the fact that international competition is especially severe.

The French Partners

1. Data-Processing Consulting Companies (SSCI)

They represent the spearhead in the software battle. Appearing first in the late 1960's, the SSCI were born in France of the conjunction of two phenomena.

First, as computer hardware manufacturers were, especially at first, unable to respond to the extremely varied needs of their customers, especially in the field of application software, there was room for a large consulting and user's assistance sector. As a result, many companies were formed around teams of engineers who had acquired expertise in this field. Some of them succeeded brilliantly and acquired international-scale dimensions and expertise.

On the other hand, as the cost of data-processing services became increasingly heavy for large enterprises, some of these tried to make them profitable so as

to better control their expenditures. As a result, they turned over part of these services to subsidiaries and made their computing power or their engineers available to other users, thus creating service companies whose field of activity progressively expanded.

To meet the growth in demand, some SSCI had to make large investments. Lacking adequate cash flow, they had to associate with large financial or industrial groups, or be taken over by other, more powerful, SSCI; during the past few years, there has been a rather strong trend to concentration in this sector.

The present structure of the SSCI industry, therefore, is good as a whole. The 10 leading companies account for 50 percent of sales in this sector, the 50 leading companies for 85 percent, and there are about 500 companies in all.

The activities of these companies generally fall into two major categories:

- Hardware services: the SSCI sells to the user a certain amount of computing power plus a number of functions and associated services, especially in the field of management and scientific computing. Data processing can take place in part at the user's (local computer or intelligent terminal) or at the SSCI's through data transfer. Finally, the SSCI can manage the user's own data-processing center.

- Software engineering: in this case, the company provides intellectual services to the user: creation of specific software adapted to his needs, or application of "software packages," i.e. standard programs that fulfill essential functions and may be suitable for several clients, turnkey systems engineering, personnel training, consulting, etc.

The following table gives a breakdown of the 1980 sales of SSCI, by type of activity:

1980 Sales: 8.5 Billion Francs

Activities	Percentage
- Hardware Services	46%
including: service bureaus	22%
teleprocessing	16%
acquisition	4%
operations management	4%
- Software Engineering	54%
including: systems engineering	12%
software-software packages	39%
miscellaneous	3%

Source: DIELI [Bureau of Electronics and Data-Processing Industry]

The total sales of the SSCI amounted to 8.5 billion francs in 1980, 10.5 or so billion francs in 1981 and, during the period of economic crisis of the past

few years, it increased by an annual average of close to 25 percent. The profession employs 38,000 people, 17,000 more than 5 years ago. In the past several years, the largest companies in this sector have made efforts to export and establish themselves abroad, and their efforts are beginning to bear fruit.

It is usually said--and it is probably true--that the French software industry (SSCI) is the second in the world after that of the United States. The SSCI profession is therefore doing well a priori and has shown real dynamism during the past few years.

Considering that the trend in the electronic branch is for an expansion of the role played by software in many fields, the expertise represented by the SSCI is essential in developing the major sectors of this branch and in making new inroads.

Yet, a closer analysis (see below) reveals a few inadequacies of this industry, which create an unstable situation where acquired advantages could soon be called into question as a result of technological changes or the emergence of new competitors.

2. Manufacturers

Initially, when manufacturers delivered their hardware, they would automatically supply the "operating system" or the "basic software," i.e. the program that would control the machine itself, and they showed little or no interest for application software. For several years now, in addition to hardware, manufacturers have been selling to their customers an ever increasing range of basic and application software. IBM has thus become the largest manufacturer and software dealer in the world.

Actually, new users base their selection more on potential applications than on the actual technical capabilities of the hardware; as a result, manufacturers must offer an increasing number of sophisticated programs in order to attract these customers.

Finally, computer performances are determined at least as much by their design as hardware as by the quality of the basic software and languages that enable programs to be operated and the increased convenience to users who are rightfully becoming increasingly demanding.

It is important for French manufacturers to engage actively in the software battle. At least, this appears to be the case in the important field of "networks" where concepts developed in the early 1970's by the former CII [expansion unknown] should now lead to products that would represent a major asset for the national manufacturer.

3. The Authorities

In the software battle, the authorities have played and are still playing an active role in several ways.

As early as 1980, the former Delegation to Data Processing had launched what, at the time, was called a "software plan" to promote and support this sector which was expected to become an integral part of the first Computer Plan.

Today, the Ministry of Research and Industry is continuing and expanding this policy, both at industrial level (DIELI) and with respect to research and technology (DESTI [Directorate for Scientific and Technological Development and Innovation]).

The Data Processing Agency (ADI) is in charge of implementing the dissemination of data-processing throughout the country's economic and social fabric, through sectorial incentive and pilot programs.

As far as research proper is concerned, the government is relying mainly on certain renowned university laboratories (Grenoble, Rennes, Toulouse, etc.) and on two specialized public institutions:

- The National Data-Processing and Automation Research Institute (INRIA); its research activities are organized around projects, many of which very directly involve software development. Some examples are its achievements in the field of numerical computing and engineering, its studies on new languages, or again its study of computer-aided design software.

- The National Center for Telecommunications Studies (CNET) which plays an active part in the development of software for switching applications and in the management of teleprocessing networks.

International Competition and the Future of the French SSCI

1. International Competition

Ranking first in Europe and second worldwide, the French SSCI profession has an excellent level of expertise. Once again, its major competitors are in the United States, especially in the field of software packages.

Until now, it is true, the U.S. SSCI, which are mostly highly specialized by subsector and by field of application, have made only timid approaches in Europe. Yet, it is to be expected that the U.S. companies will unavoidably and increasingly reinvest on export markets the technological expertise they have acquired.

Having decided to standardize their products on their own, the U.S. SSCI have been able to create an extensive market for software programs. This market, which is in full expansion in the United States, is beginning to overflow into Europe, and it would be futile to tell ourselves that cultural barriers, the specificity of the French turn of mind will be enough to contain the development of U.S. software packages when the cost differential between a program "made to order" and a standard program is of 1 to 10.

Rather than investing in the software program market and produce by themselves, the French SSCI have too often been content with selling U.S. products bought under license, thus becoming dealers for foreign products and paying back generous royalties.

Today, many U.S. SSCI have already established subsidiaries in France and are starting to market their products on their own. Will the French SSCI be able to react with all the vigor desirable?

We should also note the importance assumed in the United States by the development of microcomputer software. Companies such as Digital Research or Microsoft have made fantastic inroads within two years with software of the Visicalc type. Such software now represents the main argument in selling microcomputers. Will the French SSCI, handicapped as they are by the extremely inadequate development of microcomputers in France, be able to take the place that should be theirs in this rapidly exploding market?

Finally, the development in Europe of "hardware service" networks supported, via satellite, by strong networks on the other side of the ocean further increases the competition which French companies must face on their own ground.

2. Development of the Software Market

Certainly, it is difficult for an industry that is so young and in such a state of constant change to anticipate exactly on what ground the software battle will take place tomorrow. Our industry will succeed if it is able to take certain factors into account:

- The creation of software made to order or of the software-package type implies steadily increasing intellectual investments; to be competitive, development teams must increase their productivity and be provided with adequate tools. This is one particular goal of what is usually called "software engineering." Considerable progress has been made, especially by certain French companies. They still have to go a long way to take software creation out of the artisanal stage in which it still too often remains, whereas considerable progress are made in hardware manufacturing.

- In view of the large number of comparable hardware in a given sector, if software is to be profitable it must work on several different machines. Portability, which implies large additional investments, will increasingly become a prerequisite to the profitability of a new product.

- New markets are opening with the advent of the microcomputer, as it will bring about a fantastic demand for the most varied software packages, from the management of a small business to computer-aided education in high schools, not to mention home computer games. If this new market is to be conquered, a considerable marketing effort will have to be made; in particular, a new structure of distribution networks will be required.

- More generally, the software package market for data-processing systems of all sizes is in rapid expansion, and our SSCI must urgently regain a notable place on this market.

- Finally, the development of industrial data-processing is opening a new market for the software package industry: computer-aided design, computer-aided

manufacturing and flexible workshops, and finally the integration of all these tools into a global approach that we shall call "productics" will be essential factors in the indispensable modernization of the whole French industrial fabric.

3. Present Inadequacies of the French SSCI

To succeed on these new markets, strenghten their international position, and progress, the French SSCI must become aware of a number of their present inadequacies that deserve to be apprehended and made up for as soon as possible:

- The rapid growth of the market has mitigated the effects of competition, thus enabling the SSCI to retain their positions in very different sectors of activity. Guided by the demand, the SSCI have too often devoted themselves, as we might say, to the day-to-day development of their contracts without giving themselves development plans and adequate marketing structures. With a few rare exceptions, their medium or long-term strategies are not aggressive enough.

- For too long, the SSCI have chosen to provide men working under their control rather than taking the risk of doing the job for a flat rate. The creation of complex turnkey systems is possible only when there is sufficient expertise in software creation.

- Until now, the SSCI have not contributed much to the national innovation and development effort: the percentage of its sales which the sector is devoting to research and development is still too low. The profession's effort in the field of software creation is quite inadequate considering that this sector is expected to experience an extremely strong growth (40 percent per year) in the next few years.

- During the past few years, the SSCI have intensified their efforts to establish themselves abroad and increase their export capabilities, especially on the U.S. market. This effort should be further intensified in the future.

These four facets--long-term stragegy, research and development effort, marketing position on large (United States) and buoyant (software) markets--are indispensable to ensure the development of the French software industry.

The French Electronic Branch Plan and Software Development: National Projects

The development of the electronic branch represents the government's industrial priority. Included as a mobilizing program in the Research and Technology Orientation and Planning law, this sector has just seen its importance confirmed by the government's decision to implement a development program extending over several years. This program is essentially based on the conclusions of the report presented by the Electronic Branch Mission chaired by Mr Abel Farnoux, and which, from August 1981 to March 1982, studied the present state and potential prospects for data processing and electronics in our country.

The main characteristic of the Electronic Branch operation--and this is new in France--is that it involves the adoption of a global policy (i.e. a policy encompassing all facets such as research, industry, training, utilization, etc.), taking into account the multiple interdependence that exists between the various

sectors of the branch (components, software, professional hardware, consumer products, etc.).

From an industrial point of view, the result of these orientations in the field of software should be standardization efforts, the promotion of software engineering technology, and the development of data bases and banks; efforts will also be made to encourage the creation of distribution networks suitable for large-scale software package dissemination.

As far as the "Electronic Branch Development Expertise" mobilizing program is concerned, three major points must be mentioned:

- the national research and development effort will be intensified in accordance with the orientations contained in the Research Orientation and Planning law;

- special attention will be given to training problems, as a considerable shortage of experts, in particular in the field of data processing, is considerably hindering progress in the profession;

- priority will be given to upgrading public research through the implementation of a few "national projects."

These national projects will have a dual objective: to focus public and industrial research efforts on major themes; and to encourage the transfer of the results obtained to the industry. The themes considered will meet the following criteria:

- they must bring about a technological advance in the design of new products and services;

- they must closely associate the manufacturers and public laboratories;

- they must achieve a well-defined result (prototype, experimental service) in the short or medium term;

- they must become integrated into the strategy of one or several enterprises.

Before a national project is started, it will be assessed by all parties concerned, and they will determine its objective, the means required, the sources of financing and the project implementation schedule.

Among the projects adopted by the government last July and which will be started in coming weeks, several deal with themes in which software development will be given a choice position, especially through the use of the concept of "artificial intelligence."

- Computer-aided design of very-high-scale integrated circuits: the objective of the project will be to define and produce design tools making it possible to go around technological constraints peculiar to microelectronics and describe the circuit involved in terms of its functions; such a design tool will become indispensable in the next few years to make circuits consisting of over 100,000 transistors.

- Computer-aided design and manufacturing (CAD/CAM); the objective is to define cores in software that will make possible a high degree of automation at the various production stages, from product design to production lines; this project shall include all current studies in the fields of industrial data processing.

- Software engineering: as the cost of software is representing an increasing proportion in the price of systems, and as the development of high-performance software packages requires a large intellectual investment, the objective of this project will be to design and produce systems that will increase the productivity of analysists and software producers.

- Computer-aided translation (CAT): the objective of this project will be to produce an operational CAT prototype that will enable the industry to acquire the necessary experience and knowhow to develop an industrial activity in this new sector.

- Computer-aided education (CAE): as microcomputers and videodisks are now giving a new dimensions to the potential CAE market, the objective of this project will be to define the bases of a general educational system that will, among other things, enable teachers to write easily and quickly the software corresponding to a given curriculum.

These various projects will be carried out in close cooperation with the industry and especially the SSCI so as to ensure that research work is transferred to the industry under the best possible conditions.

Such a high degree of coordination between research teams and the industry, plus the SSCI's ambitious development strategy on a strongly expanding market will contribute much to the success of the French industry in the software battle.

Thus, the "Software Battle" appears to be a major front in the "economic war" in which nations are now engaged. It will determine not only the future of the French data-processing industry but, more generally, the ability of our industrial and marketing apparatus as a whole in acquiring the competence and independence that it requires for its modernization, and therefore for its survival and its progress.

The considerable progress that we are entitled to expect from the data-processing industry will to a large extent depend on the progress made in the field of software. Already, "expert" programs and the first applications of "artificial intelligence" are opening prospects that we would not have dared contemplate 10 years ago.

Thanks to dynamic corporate leaders who are constantly encouraged by the authorities, the data-processing service and consulting profession, taking advantage of the steadily rising demand, has been able to conquer an important position (over 10 billion francs in sales, some 40,000 highly technical jobs, remarkable inroads abroad) and is no doubt representing a major asset in our future economic development.

Yet, the time has come to increase our effort instead of slowing it down. Certain dominant positions acquired on the world market (network software for instance) are unstable and should be consolidated as soon as possible. Two remarkable international achievements of French research should not end there without having any industrial repercussions in France: the PROLOG language was adopted for the fifth-generation computer project... by the Japanese; the ADA language came ahead in a hotly disputed international competition and was adopted by the U.S. Department of Defense, but the first compiler (translating the language so it can be used by the machine) may well not be French.

We must make up for our considerable weakness in the field of software packages as soon as possible. We must at all cost take part in the world explosion of microcomputer software.

Knowing one's inadequacies is a first step toward making up for them. We are starting from a strong base. We may trust the French software industry. Yet, let us not forget that the French--no matter how gifted to write software--should not be satisfied with purely immaterial rewards: the battle of hardware and that of data-processing systems must also be won.

Success in the field of software, no matter how brilliant, could never quite make up for a defeat on the front of hardware and data-processing systems.

But, as Rudyard Kipling said, this is another story...

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RTC: FRANCE'S SECOND LARGEST COMPONENTS PRODUCER ASSESSED

Doing Well After Restructuring

Paris ELECTRONIQUE ACTUALITES in French 13 May 83 pp 1, 18

[Text] Following the reorganization plan begun 2 years ago and losses of 35.4 million francs in 1981, RTC, France's second largest components firm, balanced its accounts in 1982 and had a sales turnover of 2.440 billion francs, up 14.9 percent over the preceding year. With adjustments made for a 10 percent inflation rate in 1982, the RTC that year, during a period of international crisis, had a growth it had not known for a long time.

With a much higher rate of inflation, the company's growth was 6.9 percnet in 1981, 5.5 percent in 1980, 7.4 percent in 1979, and 8 percent in 1978. Does this mean that RTC is avoiding any problems with production costs in France and with international competition? No. The company just carried out its reorganization plan in time and is taking advantage of the fact that it belongs to a multinational, Philips, which has the advantage for RTC of being of European origin.

RTC also benefited from a satisfactory television market in 1982; without television tubes, the growth of RTC's CA [Turnover] would have been over 2 times less.

It will be seen that product lines dropped by RTC, particularly capacitors, have not had too great an impact on the CA. These capacitors and some other items are now imported from other Philips plants located in different regions of the world, including the Far East.

Hyperelec, a 100 percent Philips subsidiary, but whose work is related to that of RTC, in 1982 had a CA of 174 million francs, up 30 percent over 1981. Its exports, 101 million francs, increased by 44 percent, essentially because of night vision tubes.

GP [Mass Market] Tubes Showing a Profit

Growth by sector can be seen by considering the changing structure of RTC's sales. In 1981, this structure was: 39 percent for TVC [Color Television] tubes, 8 percent for professional tubes, 25 percent for semiconductors, and 28 percent for passive components.

In 1982, it was: 41 percent for TVC tubes, 9 percent for professional tubes, 23 percent for semiconductors, and 27 percent for passive components. So the increased earnings of RTC in 1982 were due primarily to tubes for the mass market. And the Dreux plant is no longer operating at a loss.

RTC's semiconductor sales, approximately 561 million francs, were up 1 percent over the previous year. It was not reported whether this disappointing result is due to a slowdown in sales of the ECL [Emitter-Coupled Logic] circuits made in Caen, essentially for export (80 percent) or to a downturn in sales in France of Signetics products or products made by other Philips subsidiaries. Sales of other semiconductors made in Caen (opto, power, hyper) have increased only slightly.

In addition to sales to the group, RTC still makes a little more than 25 percent of its sales to the mass market sector. RTC sales outside of the group make up "from two-thirds to three-fourths of its revenue."

Exports: Up 16 Percent

RTC's export earnings are good, since its sales were 757 million francs, up 15.8 percent (up 7.7 percent in 1981; down 9.9 percent in 1980; up 5.5 percent in 1979; up 1.4 percent in 1978). But for a company which has the advantage of the Philips worldwide sales network and of its almost captive market for some components of the group's systems divisions, RTC's exports seem relatively low. Its export percentage was 36.4 percent in 1978, and 31 percent in 1982. And when we think that France accounts for only 3 to 4 percent of the world components market! But this comment should be nuanced when making any comparison with other companies, as RTC's sales include a portion of resale of Philips components, a portion which has never been revealed, but which is probably about 30 to 35 percent of its revenue today." For example, if it were 35 percent, this would mean that the revenue based on French production was 1.586 billion francs, with 48 percent of this production being exported.

RTC's 1982 investments (122 million francs) were only slightly up in constant francs in relation to 1981 (113 million francs), 1980 (121 million) or 1979 (117 million) investments. The amount spent on research and development was 8.5 percent of the company's revenue, including the part of the LEP [Laboratories of Electronics and Applied Physics] activities supported by RTC.

Evreux Production Center Described

Paris ELECTRONIQUE ACTUALITES in French 13 May 83 p 19

[Article by J.-P. Feste]

[Text] RTC must believe in the future of the European printed circuits market, since they have made such large investments (the amount has not been revealed) in production equipment, including a metal-plating line of over 100 linear meters with 20,000-liter vats and cathodes processing 7 m^2 of circuits at once.

This may well be the conclusion after the visit sponsored by RTC for the press to its Evreux production center on 4 May of this year, 6 months after its latest equipment began to function.

The plant's maximum potential has been increased to 400,000 m^2 ayear of circuits with non-metallic holes and to 220,000 m^2 a year of printed circuits with metallic holes, including multilayer circuits.

In 1982 the non-metallic hole line operated at nearly 90 percent of its capacity, but the metallic-hole and multilayer line operated at 50 percent capacity. The electroplating line has a capacity of 220,000^2. This is the most important of the heavy equipment. The peripheral equipment: drills, engraving machines, presses, etc. are not yet ready to operate at full capacity (100,000 m^2 a year). However, RTC, in its plans for its work surface area, has incorporated the possibility of expanding its stock of peripheral equipment so that it will be able to match the capacity of its electroplating line.

Exports: Betting on the Future

RTC's hopes for the future are pinned on exporting its printed circuits, and among the comments of its top staff, we often hear: "We are now demonstrating that exports are possible." These

direct exports of printed circuits were about 7 percent in 1982 and 15 percent when the group's captive market is included. This is about 50 percent of the total production of printed circuits. This figure of 15 percent should rise to approximately 17 to 18 percent in 1983. But these figures are still low, when compared to some European manufacturers who reportedly export up to 30 percent of their production.

This reliance on exports is certainly reasonable. It is clear that the French market can not absorb the production capacity of RTC's heavy equipment, and in addition, this market seems to be lagging behind, in relation to the recovery that has already begun to appear in Great Britain, and which is gradually spreading through Scandinavia to Germany. According to a Frost and Sullivan study, the annual growth of the European market until 1987 should be 6.9 percent a year, with a total amount in 1987 of $571 million. But foreign manufacturers do expect an upturn in the French market in 1984/1985 after a European recovery which is now beginning to take shape. RTC's export program is aimed primarily at two European countries: Germany and Great Britain. In 1981 the Germans had a bitter price war on double-sided printed circuits, which brought about a price reduction of nearly 30 percent. The British market, which is the second-ranking in Europe in terms of size, should rise from $285 million in 1980 to $461 million in 1987, an annual growth rate of 7.1 percent.

Investments will have to pay off during the 1983-1987 period for, at the end of the decade, a new depression in the market could reappear.

Printed circuits are no longer produced by light equipment, at least when we are thinking in terms of large-scale production. The directors of RTC, though not wanting to try to look into a crystal ball, do estimate that in the years to come, only the large European circuit producers will survive, accompanied, though, by some small provincial producers, who would act more like craftsmen than like industrial producers.

The mid-term vision does not seem to take into account the export possibilities of medium-sized industries in a European market. But such companies could be in a position to offer some original concepts, for example, in the field of circuit substrates.

The Markets Sought

RTC is interested in all the markets in this field, from prototypes up to five circuits, from medium and large-scale production of metallic-hole, multilayer circuits, to the mass production of single and double-sided circuits with non-metallic holes.

Among other manufacturing methods, the Evreux center uses as subtractive or semi-additive methods, liquid photosensitive soldering reserve techniques, and selective plating.

The semi-additive method is distinguished from the subtractive process by the use of phenolic paper, glass, or bare epoxy paper, while in the conventional subtractive method, the sheets are first coated with copper.

The bare sheets first have holes punched by digitally controled drills, and then are given a chemical copper coating. This coating is very thin, only a few microns, and is not comparable to the copper coatings of several tens of microns used on standard sheets. Then serigraphic reserves are made, using alkaline inks that are polymerizable in either infrared or ultraviolet. Then, after an electroplating of copper and lead tin, and the stripping off of the serigraphic reserves, the circuit is engraved. In this process, the engraving attacks only the very thin chemical copper deposit at first. So the advantage of tnis type of fabrication is the short duration of the engraving process, and the small amount of electricity required. The following phases concern the development of a soldering reserve area by photography or seigraphy followed by selective plating. The widespread use of a protective varnish has led RTC to apply this liquid varnish by a "curtain" system which enables the resin to be distributed in a regular thickness. The resin is dried and then exposed by a photographic process, then developed and polymerized.

Electrical tests complete the fabrication phase. Depending on the level of production involved, the tests are done either by automatic equipment (up to 1,800 pieces per hour) or by medium-capacity testing devices (up to 8,000 points), or by high-capacity testing devices (there is one of 33,000 points), equipped with universal matrices with a spacing of 2.54 mm, 1.27 mm, or 0.635 mm.

CAO Design

The Evreux center also designs circuits using CAO [Computer-Aided Design] systems. A new piece of equipment has just been installed and now double-sided and multilayer circuits can be handled. This equipment has the possibility of handling 3,000 connections on the same circuit board, with an option of extending this capacity to 3,500.

Then in the more or less long-term period, the company should have a system for client-supplier information exchange, in the form of digital data, which will replace data, photographs, and plans.

We should also mention that the European producers of printed circuits, which are big exporters, also plan to acquire this type of equipment.

7679
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SIEMENS FINANCIAL STRENGTH ASSESSED

Paris ELECTRONIQUE ACTUALITIES in French 8 Apr 83 p 16

/Text/ The Siemens name is often brought up these days with regard to a possible cooperative effort in data processing with the English ICL, and the French CII-Honeywell Bull, with regard to recovery of Grundig in association with Philips and Bosch, and with regard to the agreement on research concluded with Bosch. It therefore is necessary to remember what this giant of the German electronic and electrical industry represents and to know how to measure its financial strength. All the more so because, after a period of stagnation, the firm has just seen a renewed growth in its profits.

For the fiscal year ending 30 September 1982, Siemens announced a 16 percent increase in its turnover, which reached 40.1 billion DM, or the equivalent of 120 billion francs. It has especially increased its declared earnings by 45 percent, which now amount to 738 million DM (more than 2.2 million francs.)

Break in Stagnation

This performance is a break from a long period of decline. From fiscal year 1977-78 to 1980-81, the turnover had only advanced from 29 billion DM to 34.5, and declared earnings had dropped from 674 million to 493 million DM. Siemens was considered a drowsy giant without prospects for real growth. The value curve on the stock market faithfully reflected this view. On German markets, stocks since early 1977 had never risen above 300 and for a while had fallen below 200. Actually, they fluctuated around 250 for a good half dozen years.

Do the 1981-82 results mark a lasting change in direction or are they a fortuitous accident in a so-so development?

To answer this question, it is first necessary to try to analyze the reports of this good year which ended in September.

The development of activity is a completely secondary result of the recovery. The entry, for the first time, of the American branch, Siemens-Allis, in which the group increased its holdings from 50 to 85 percent, is the primary cause

for the increase in turnover. With comparable data Siemens would have only registered a 6 percent increase, stimulated as well by the large orders received by its branch company, KWU. This "only" merits explanation for the French reader who should not forget that Siemens' receipts are described in hard currency. This has a double consequence: the firm works in a country where inflation can hardly be counted on to artificially swell invoices; foreign sales, once converted into German currency, are reduced by the rise of the mark which has increased in value in comparison with almost all currencies, except the dollar.

Because the rise in profits was far greater than the increase in turnover, the obvious result is that profit margin grew again: it rose from 1.5 to 1.8 percent based on declared earnings. But, it was 3 percent a few years ago. This is what shows that Siemens has only interrupted the decline in its profit-making capacity.

This interruption has some chance of lasting; it depends primarily on a stricter, German-style management.

--Investments made for several years have been based on increase in productivity. The result is seen in the regular decrease in manpower: 317,000 today compared with 334,000 a little more than 2 years ago. This phenomenon will likely repeat itself. Expenses for personnel have thus been curtailed.

--Unprofitable products have been dropped from the catalogue.

--Stocks have been consolidated and the financial situation has thereby been strengthened.

--All those measures permitted improved results from almost all profit-making activities and ended or reduced losses in deficit areas, which is the case with data processing and electronic components.

An 11 Billion DM War Chest

All this relates to the financial situation. Liquid assets increased from 2.5 billion to 11.1 billion DM, or more than 33 billion francs, an action which indicated both stock consolidation and reduced financing needs. By the same token, while French firms were often somewhat squeezed dry by financing costs, interest from investments and loans increased Siemens' earnings.

Siemens is therefore reinvigorated. Its available funds permit it to consider the future calmly and to think of repurchasing other firms. In addition, the company decided to issue stock at 100 DM for 20, which will bring in 200 million and help the shareholder because of the low issue price. This positive financial situation is only in small part the consequence of a slow-down in investment which rose to 1.8 billion in the last fiscal year, and which will be at the same level this year, compared

to 2 billion previously. But research expenses reached a record high with 3.3 billion marks, equal to 10 billion francs, or 8 percent of the turnover. Moreover, the firm attributes the positive results to its technical progress, which enabled it to do better than half of the industry.

What are the strong and weak points at Siemens? Geographically, Germany remains the strong point, even though foreign branches have become notably stronger, representing 37 percent in the last fiscal period compared to 51 percent a year before. The entry of Siemens-Allis and its billion marks turnover greatly contributed to this advance on the part of the foreign branches.

Furthermore, the role of the United States is bound to widen. Recently, the firm acquired the equipment distribution and electricity control divisions of the American firm, Gould. This represents a half billion DM. In all, Siemens is worth 3 billion marks in the United States, and without a doubt, 3.5 billion this year. Siemens has 4 overseas divisions: communications, medicine, components and Siemens-Allis, which makes turbines and electrical equipment for industry. The divisions purchased from Gould will be connected to Siemens-Allis.

There is no doubt that Siemens, like many European companies, wants to go farther on the path of Americanization. The president of the company, Dr Karlheinz Kaske, feels that his firm is still very small in the United States, a country which makes up one half of the world electric equipment market.

In the United States, Siemens is obviously very far from holding the share of the electric equipment market it is accustomed to having elsewhere. In Germany, this share has risen from 18.4 percent to 18.8 percent during the last fiscal year and in Western Europe, from 7.3 to 7.5 percent.

As for kinds of activities, Siemens hardly goes into detail. Telecommunications, with a little over 11 billion DM in receipts, or almost 30 percent of the turnover worldwide, is the main activity, closely followed by electrical energy. The remainder added up amounts to about 45 percent of sales, which include components, software, electrical facilities and medical electronics. For example, the important subsidiary, Osram, specializing in electrical lighting, is in the installations category.

Among the subsidiaries, KWU (Kraftwerk Union), the essential link in the Siemens electrical energy chain, has to be mentioned. After dealing with many disappointments from delays in nuclear plant programs, the company is clearly showing a profit of 50 million DM compared to 35.

Two branches at 50 percent ownership should also be mentioned, Polygram (records and cassettes) and Bosch-Siemens (electric home appliances, mass market electronic items) which has just taken over Neff kitchens from AEG and could play a role in Grundig.

Data Processing and Components in the Red

Information systems and components have limited weight in the enormous Siemens structure. The turnover in data processing is on the order of 2 billion DM, which would rank it in Germany behind IBM and even Nixdorf. Up until now, these two activities constituted a handicap in terms of results since they have been regularly in the red these last years.

However, they did better in the last fiscal year. The debt, which was 200 to 300 million, had to be reduced to more reasonable proportions, despite the unfavorable situation in components. It is evident that Siemens does not have the same power in this domain as it has in others. This is a problem for the future and perhaps the impetus for future initiatives in Europe or in the United States.

The Status of the Current Fiscal Year Begun 1 October

Its first trimester was affected by an unusual phenomenon. A rush of orders from Germany, taking advantage of the investment premiums which expired 31 December, made sales registered on the national market go up 75 percent compared to the corresponding trimester of the preeeding fiscal year. The overall picture shows a 25 percent rise, despite a 7 percent decline abroad.

Siemens fears that this trend may take a downturn and envisions a standstill in orders for the fiscal year overall. The plan of attack is still well funded with 57.4 billion DM. For the first trimester, the turnover did not change but profits advanced 11 percent, to 160 million DM. The improved profit earning capacity is, therefore, confirmed, as even shares have risen in anticipation of a nuclear plant order for KWU.

Real Profits Exceed One Billion

Although the company considers its financial perspectives constrained by some conditions, it is not imprudent to count on a new increase in profits. This is what is happening rapidly on the stock exchange where shares have risen way above 300 in the best trading ever. Siemens is valued at more than 13 billion marks, or close to 40 billion francs. This is much more than Philips of Westinghouse, but less than either the English or American General Electric or the large Japanese companies.

This capitalization on the stock market could even seem excessive compared to declared earnings which would have to be counted 20 times to be equivalent. Here German accounting must be considered, which diminishes total earnings. For Siemens, analysts recalculate a real profit which is much higher: more than a billion marks for 1980-81 and according to early estimates, approximately 1.4 billion for the last fiscal year, or 35 DM a share. Only this recalculated result permits comparisons with company profits in other countries.

This shows that the stock exchange rate is less than one tenth the net profit, which is reasonable. Yield on shares is on the order of 4 percent for German stockholders who enjoy a fiscal advantage because Siemens, always cautious, places almost all its profits in reserve and distributes dividends which have not changed in four years.

9675
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FRENCH INDUSTRIAL ROBOTICS INDUSTRY ASSESSED

Paris L'USINE NOUVELLE in French 9 Jun 83 pp 168-175

[Article by Patrick Piernaz]

[Excerpts] General Electric, IBM, Westinghouse, Bendix, General Motors... The American multinationals are crowding into the robotics market. The French companies, Renault, Matra, and CGE [General Electric Company] will have to move quickly to accept this challenge of a race toward the factory of the future. But these large-scale maneuvers represent only a part of the industrial stakes involved. The area of specialized equipment is the specialty of the PMI [Small and Medium Industries]. With AKR, Sepro, or Afma, French industry can also play a winning game, even on a world level.

A Clash of Giants, Which Could be Determined by Small Companies

Barely had the sides been chosen when we could see the start of a real clash of giants. This is a battle which might well be determined by small companies, such as Automatix in Boston, which quickly learned to look to the future and specialize in robots for automatic welding with control and followup of connections. Automatix, which was established in 1980 by a former staffer from Computervision, Philippe Villers, has had a mushrooming growth: 3.15 million francs in 1980, 21 million in 1981, and 56 million in 1982.

In this worldwide struggle, we do have to count on the presence of the Japanese. They had a year in 1982 that was slightly under their forecasts, but which still showed a production increase of 30 percent (40 percent had been predicted), reaching a total of approximately 4.4 billion francs (140 billion yen). In addition, the largest firms in this sector, such as Fanuc, Dainichi Koki, Mitsubishi, Hitachi, Sankyo, Yaskawa, etc., have

all signed licensing or manufacturing agreements with American or European firms.

In a number of areas, the Americans have settled back and folded their arms, deciding to buy Japanese. Their reasoning consists of letting the Japanese produce hardware cheaply, so they can better concentrate on research on software, artificial intelligence, shape recognition, etc., while at the same time creating for themselves an image of overall designer, or of an engineering specialist in robotics. This way of thinking seems sensible, but may perhaps be somewhat presumptuous, when we take a look at the distribution of the world market.

Unimation, with about 15 percent of the world market, now has just a slight lead over a crowd of Japanese firms: Fujitsu-Fanuc, Hitachi, and Kawasaki, which are very close to 13 percent of the world market. This can be explained by the extent of the Japanese market, the largest in the world, with 14,000 robots now installed, while there are 6,000 in the United States and 5,000 in Europe.

Europe is practically a nonparticipant in this worldwide "Kriegspiel." There is one exception, though: the Swedish company Asea, whose unerring moves have taken it to a position among the world leaders. In 1982 Asea produced 1,000 sophisticated robots, for robotics sales of 500 million francs (the same level of sales as Unimation). The head of Asea's industrial robots division, Bjorn Weichbrodt, wants to go even further: "Our objective is 20 to 25 percent of the world market by 1985." The company's strength is based on the fact that it has a line of six-axis electric robots with a payload range from 6 to 90 kilograms, and for the past 18 months it has also been able to offer Electrolux handling devices. It now holds 49 percent of the Electrolux stock.

In order to grow, Asea first relied on a promising and precocious Scandinavian market, and it also managed to place its products in other European countries at the right time, during the boom in spot welding in the automobile industry, particularly in Germany. Just in 1982 alone, Asea reportedly sold a total of nearly 300 robots to BMW, Daimler-Benz, Audi, Opel, Volkswagen, etc. In addition, it has begun an industrial offensive aimed at some foreign countries. Two Asea plants have now been started, in the United States and also in Spain. The same strategy is being used for sales in France. The first of Asea's "made in France" robots will soon begin to emerge from

the Persan-Beaumont plant. "That will be a true French production, and not just an assembly of Swedish components," asserts Gilles Breguet, the P-DG [Chief Executive Officer] of Asea France. "We will produce in France over 50 percent of the value added to these robots."

Moreover, Asea is going to continue to buy French components: electric motors, ball screws, resolvers, and bearings. What is even better is that it will buy electric motors from CEM [Electromechanical Company] and will send these motors from France to other factories belonging to the group. "Right away, that means that our balance of trade in robotics is balanced; we export as much as we import," points out Gilles Breguet.

Asea France: Orders Multiplied by Four in 1 Year

By using French products, the Swedish group will enable its French clients to take advantage of the MECA [Advanced Design Machines and Equipment] procedure, which provides financial assistance for companies which wish to acquire robotic equipment. That is a good way of continuing to expand in France. The level of orders received by Asea France increased from 6 million in 1981 to 25 million in 1982, and it should reach 50 million francs this year, with the production of 100 robots.

These figures place Asea France second, behind Acma-Cribier of the Renault group, the undisputed leader in the French market. Its production (120 robots in 1982) has made it one of the few companies that can claim to play a significant role in this market. And yet we must not lose sight of the chasm that separates the French leader from its foreign partners (the ratio is 1 to 10). This is so true that we might well wonder whether France may not have already lost the battle for the world market to the big companies.

At the ministry of industry and research, they avoid any defeatism, commenting (and rightly so) that the real battle will come in the decade from 1985 to 1995. In addition, the producers claim that at the present time the market is primarily based on the automobile industry and its subcontractors, which use nearly 75 percent of the robots made. In this area, France meets its needs well, with Acma which provides robots for French plants, and for the PSA group, Citroen Industrie, which has Barnabe, a six-axis electric robot, of which 15 units are to be used on the BX production line in Rennes. In all, Citroen plans to produce 250 robots. Their production has just begun

in the brand new flexible workshop at Meudon, at the rate of eight units per month.

While spot welding is still the most important application, other applications should little by little take on more significance. This was the conclusion of the latest Diebold France study, which predicts that surface treatment will follow the rate of expansion of the market until 1986, and that at the same time, loading-unloading of presses will have a growth rate of 15 to 20 percent a year, then will level off in 1985. Beyond that, arc welding with monitoring of connections seems to face a promising future (25 percent of sales in 1988). Two other applications should also experience a boom at that time: handling in flexible workshops, and assembly, which could account for 50 percent of sales toward 1990. And as if by pure chance, IBM is now showing an interest in assembly. So it seems clear that French industry can still play in this game, particularly in the areas of handling and assembly. But a decision on investments and research will have to be made without any further delay.

Renault: a Major Role to Play

In France, three groups are in the running: Renault, Matra, and CGE. For each of them, the equation is the same: they must have significant resources available, comparable to some extent to what Westinghouse, General Electric, or Asea could use. They must produce in sufficient quantities (no production line with less than 100 units per year), and have a complete array of skills (CFAO [Computer-Aided Design and Manufacture], software, numerical control, robots, etc.).

Thoughts turn immediately to Renault, which meets most of these criteria, and is even out in front in worldwide technology in the area of flexible workshops. In addition, it is also a big client. Just like the big American and Japanese companies, it can turn work over to its own facilities, providing itself with a captive market. Unfortunately, the time for making such a decision has come at a bad moment for Renault, which is straining its resources nearly to the point of exhaustion to win other battles in the automobile and truck industry. "We can't finance such large investments at a time when Renault is mobilizing all its resources in order to improve its position in the automobile industry," states bluntly Freddy Balle, the P-DG of Renault Industrie Equipments et Techniques (sales of 1.6 billion in the automation of discontinuous processes).

The World Robotics Market

Pays (1)	(2) Production annuelle	(3) Production cumulée	(4) Production cumulée (robots haut de gamme d'un prix supérieur à 150 000 francs)	(5) Valeur moyenne (en francs)	(6) Valeur annuelle (en millions de francs)	(7) Valeur cumulée (en millions de francs)	(8) Effectifs construisant les robots
Japon (9)	11 000	43 000	4 750	70 000	780	2 600	3 750
Etats-Unis (10)	8 130	19 000	3 800	120 000	980	2 300	3 420
Europe	5 377	17 275	4 517	142 000	753	2 457	5 319
Scandinavie (11)	560	2 060	1 600	340 000	190	680	700
France	1 037	3 815	687	180 000	188	304	838

Key:

1. Country
2. Annual production
3. Cumulative production
4. Cumulative production (top of the line robots costing over 150,000 francs)
5. Average cost (in francs)
6. Annual value (in millions of francs)
7. Cumulative value (in millions of francs)
8. Workforce building robots
9. Japan
10. United States
11. Scandinavia

Note: These statistics, taken from the report of the Robotics Mission of the ministry of industry, are a year old. To update them, we must take into consideration the evolution of the market, which is growing at a rate of 25 to 30 percent. French cumulative production is today close to 1,000 top of the line robots.

Matra is not involved in the same area, so it would be in a better position to mobilize its forces to work in this area. Its "control and automation systems" branch has some competence in robotics: Sormel (assembly robots, handling devices); Interelec (self-guided carts); Matra-Datavision (one of the few French CFAO companies involved internationally); Jaz Industrie (flexible assembly centers); and Manurhin (numerical control and flexible cell engineering). All these companies have a solid commercial structure, for exports as well as for the domestic market. Exports make up 20 percent of Sormel's sales and up to 84 percent of Interelec's sales.

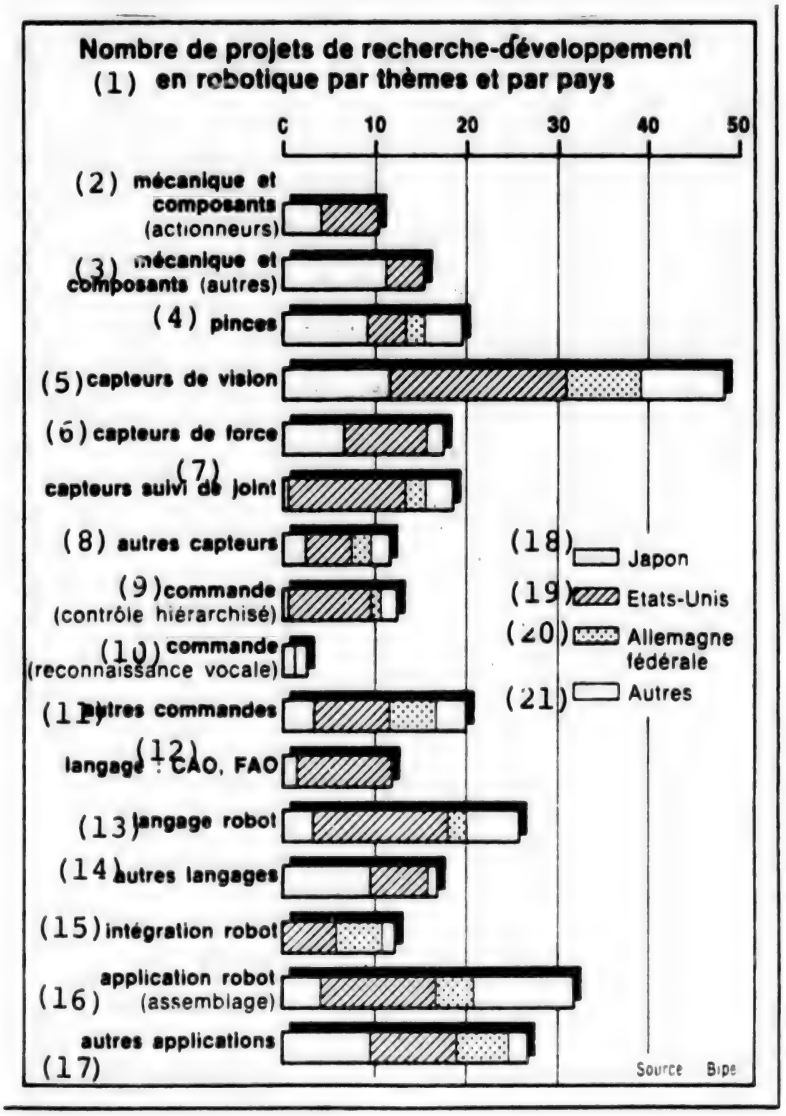
Renault can not boast of a similar commercial structure. Acma has sold very little on the export market and has practically only two clients: Renault and PSA. However, Renault does have an unequalled research capability with its advanced automation systems and techniques division. One of its strong points is shape recognition. It doesn't take any great degree of brilliance to perceive the interest that both companies might have in joining forces. "We feel that working with Renault is the best possible solution," confirmed Jean-Claude Lagardere, P-DG of Matra, at the latest Le Bourget Air Show. The negotiations begun by the two groups will lead to a splitting of the market, with Matra getting small assembly robots, and Renault concentrating on larger robots. Both groups would then pool their export facilities.

CGE will also have to manage to get different entities to work together, in order to become the second major French industrial focal point in robotics. This interest in federating its varied fields of expertise has not escaped the attention of the group's management, which has appointed a person to assume responsibility for CIM [Computer-Integrated Manufacturing] coordination. This is Jean-Claude Peugeot, now with the division of development. His job will not be an easy one, but it may result in an extraordinary synergy of competence. For within its territory the CGE--with the help of Alsthom-Atlantique and some others--has a number of high performance companies in robotics, process control, CFAO, and components. Just in robotics, it has three very dynamic companies: ACB in Nantes, the CGMS, and the SCEMI. In order to round out their product lines and gain a better grasp of the market, all of them have signed agreements with Japanese firms: OKK for ACB, Sankyo Seiki and Toshiba Seiki for CGMS, and Yaskawa for SCEMI. And the ACB is not willing to just sell robots. This company also sells complete systems ranging in price from 300,000 to 3 million francs, with positioning devices designed and made in Nantes, which make up a large part of the final product.

The same is true of the CGMS, which is already involved in the development of four flexible workshops. By the end of this year, this activity alone will amount to sales of 40 million francs. The SCEMI has gotten off to a good start in the area of small assembly. It should sell 50 units of its new robot this year, and 200 in 1984.

Another large company interested in robotics is Thomson. Its subsidiary, Auxilec, which has just taken over European Automation in Caen, has signed some important agreements with

Dainichi-Kiko (Japan) and with DSR (Great Britain). Thomson has two advantages in flexible workshop engineering: Sodeteg-TAI and TITN, which have worked on the majority of the French flexible workshops.



Research: the Japanese Advance

Key:

1. Number of r & d projects in robotics, by topic and by country
2. Mechanics and components (activating equipment)

3. Mechanics and components (other)
4. Grips, clamps
5. Vision sensors
6. Force sensors
7. Connection monitoring sensors
8. Other sensors
9. Control (hierarchical control)
10. Control (voice recognition)
11. Other controls
12. Language: CAO, FAO [Computer-Aided Design, Computer-Aided Manufacturing]
13. Robot language
14. Other languages
15. Robot integration
16. Robot application (assembly)
17. Other applications
18. Japan
19. United States
20. Federal Republic of Germany
21. Others

But the French chances for involvement in this field are not limited just to Renault, Matra, and the CGE. Making that assumption would indicate a poor knowledge of the market, which now, more than ever before, has split into two quite distinct segments: one part of the market involves standard equipment produced in large volumes, and large computerized workshops, which the French are going to make an attempt to establish themselves in. The other market segment involves more specialized equipment for specific needs, which requires much less costly investments (in this case, it is primarily a matter of financing growth).

While in the first market segment, which is of interest to the larger companies, the French have to make up for lost time, in the second segment, French PMI such as Sepro, Afma, AKR, Industria, Albora, AID, etc. are off to a good start. They are the ones which will win back--or win for the first time--the domestic robotics market.

Sepro: A Quite Remarkable Success

The case of Sepro is truly remarkable. This company with 30 employees located at La Roche-sur-Yon is already first in France and second in Europe in bar transfers for the automation of presses in the mechanical industry. It has just diversified

and has taken first place with the automation of plastic injection presses. Even better: it has succeeded in gradually displacing the Japanese from the French market! "Our strong point is that we chose rigidity and digital control of the axes," said Bernard Elineau, commercial director. "For that reason, our equipment does more than just unload machines; it can present the piece in a given position and palletize it." Sepro's turnover has climbed from 12 million francs last year to 20 million this year, and its production of robots for plastic injection presses has increased from 40 to 100 units sold (their cost ranges between 75,000 and 250,000 francs). And the market is enormous: just in France alone, 16,000 plastic injection presses are unloaded by hand. "We hope to equip up to 25 percent of the market," said Mr Elineau, who is now preparing to export his company's products to Europe and America.

The U.S. market has already become a reality for AKR [AOIP Kremlin Robotics] which, despite its size (60 employees and 26 million in sales, 60 percent of it from exports), has managed to win a $1 million contract to provide painting robots for the U.S. Honda plant in Marysville, Ohio. Maurice Lande, the director of AKR, is convinced that the expansion of his company depends on "exports, particularly to the United States, which makes up 50 percent of the market." Now AKR will have to work to make its worldwide expansion a success. The firm, which did manage to balance its books in 1982, is cruelly short of financing. A year ago, it was ready to sign with Asea, which would have given it the resources to produce in large quantities and an international commercial network. Now, after the government's refusal, Maurice Lande is still waiting for French investors, who have been appealed to by the ministry of industry and research, to offer him investment funding.

Financing development is the stumbling block facing the PMI in robotics. "We must not lose sight of the fact that robotics is a difficult industry, which demands simultaneously recruiting specialists (who can't be found), creating a market from clients who are uninformed, and supporting high research costs," said Pierre Margrain, P-DG of Afma Robots, who admits to spending up to 50 percent of his company's turnover on research and development and on commercial prospecting.

Afma's big advantage (the company has 30 employees and a totally new plant at Chambray-les Tours) is that it can rely on two big stockholders, Leroy-Somer and La Telemecanique (via NUM SA), who have agreed to raise the firm's funding to nearly

7.5 million francs. Afma is growing regularly: its turnover has risen from 3.4 million francs in 1981 to 6.1 million last year, and it will certainly reach 16 million this year. The company is concentrating on hardworking handling equipment: manipulators, containerization robots, crane robots, and on its two latest products: the R 3 (a small "apprenticeship" robot for flexible cells of machine tools), and an innovation that is going to make the Japanese jealous: a loading device with a special belt for lathes so that the machine can be supplied without stopping the spindle.

Innovation is the strong point of PMI such as Industria in Plessis-Trevise in the Paris region. The company has 90 employees and sales of 23 million francs in aeronautics. It has developed an interchangeable hand for robots. The firm's director, Robert Caen, doesn't worry about competing with the industrial giants: "Our advantage is that we don't offer our clients a fixed robot, but a made-to-order piece of equipment based on standard features adapted to meet our client's particular problems, with full service, which even includes maintenance training."

The same is true of AID in Grenoble, which has developed a robot for bending presses and is doing research in the wood and woodworking industries. Such examples could be multiplied easily with other companies, such as Commercy, Sciaky, CSEE, Climax, Barras Provence, etc. All of them are prepared to strengthen the French robotics industry, which is growing at a rate of 20 to 30 percent a year, but 60 percent of whose profits go to foreign manufacturers.

There is one reassuring factor in this area: the close ties that seem to be established between the companies and research laboratories. ACB signed an agreement with the CEA [Atomic Energy Commission] to develop second-generation welding robots; SCEMI is a direct spinoff of the ARA [Advanced Automation and Robotics] research project; and Industria is working with ENSAM [National Advanced Engineering School]. In a similar way, the Albora robot is the result of collaboration between three leaders in their specialties: Allibert, Ateliers Bouvier, and Merlin Gerin. In addition, a number of companies have decided not to manufacture themselves. They subcontract the machining work and do only the research and assembly-control, thus avoiding two difficult areas which in the past have weakened the French machine tool manufacturers.

New Client Sectors: Penetration of Robotics into Different Sectors of the Manufacturing Industries

Industries	Percentage of jobs	Percentage of robots 1980	1990
Food, beverages	3.7	insignificant	2-3
Coal, oil, chemicals	2.4	"	
Metallurgy	1.2	"	
Metal transformation	1.2	9	28
Mechanics	4.7	8	
Metal transformation (semi-finished)	2 to 3	1 to 2	
Instrumentation	0.7	insignificant	19
Electrical industry	2.1	6	
Electronics	1.7	5	
Ship construction	0.9	insignificant	
Automobiles	2.7	58	
Aeronautics and space	0.8	1	38
Bicycles, motorcycles, other means of transport	0.9	2	
Light manual tools	0.5	<1	
Textiles, leather, clothing construction	5.2	insignificant	12 to 13
Ceramics, materials	1.4	5	
Wood, furniture	1.3	>1	
Paper, printing	2.7	insignificant	
Rubber, plastics	1.3	4	
Other processing industries	0.5	insignificant	

Table prepared by the Robotics Mission based on Diebold data. Percentage of jobs in the sectors considered in relation to the active population in industrial sectors.

A final reason for satisfaction is the intention of the minister of industry to spend, in order to stimulate the supply of CIM in France, between 800 million and 1.2 billion francs per year over a 4-year period. This is between 2 and 3 times the budget package for the machine tool plan.

In the field of robotics, the amounts of capital invested are growing larger all the time, as financing the development of products to be sold throughout the world is very expensive.

Six Families of Robots

There is a good deal of disagreement about the meaning of the term "robot," so that, in order to make sure they understand each other, specialists have classified robots, in the strict sense of the term, into six categories:

a. A manual handling device, or remotely controlled handling device, for work that would be painful to do or which must be done in a hostile environment.

b. Fixed-sequence robot, particularly a pneumatic thrust robot (quite widespread).

c. Adjustable-sequence robot (requires phase-locked motors).

d. Apprenticeship robot.

e. Numerically-controlled robot.

f. Intelligent robot (has sensors. Example: camera).

We should realize that in statistics the term of top-of-the-line robot with numerical control or apprenticeship robot is often used. But these are often five or six-axis robots with electrical or hydraulic control, like those used in automobile construction.

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AUTOMATED WORKSHOPS PLANNED FOR SMALL, MEDIUM COMPANIES

Paris L'USINE NOUVELLE in French May 83 p 15

[Article by Michel Defaux]

> [Text] On one side, flexible shops of high sophistication for big companies; lots of flexibility, medium output. On the other, automated shops that profit by what the big ones learned, designed for small and medium companies; not much flexibility, but automated machine operation allowing better handling of flows. The first ones will be starting up before the year is out.

Up to now, flexible manufacturing shops were monsters, designed by and for big companies, like those at RVI Bouthéon (running for a year now) and at Citroën Meudon (that one will be starting in June). For small and medium companies, these are not the ideal solution: a lot of flexibility to accommodate manufacture of different parts, not much production, a high price-tag, lots of computer experts and maintenance personnel...

Shorter Delivery Times, Lower Operating Costs, and Payroll Savings

Meanwhile, for the past few months, we are seeing plans for automated shops designed to meet the needs of small and medium companies (PMEs). "The men who head small and medium companies, who are taking ever-keener interest in this concept of flexibility, keep calling us," says Daniel Armand, marketing relations director for Associated Engineers and Designers, or Idessa for short. "It's a new concept that is beginning to gain acceptance, thanks to computers."

Of course, the automated shops developed for the PMEs will be quite different from conventional flexible shops. The aim is primarily to increase production through better flow management and via extended operation time for the machine, leading to shorter completion times and better response-time for the client,

and the price of those advantages will be less flexibility in the kinds of parts manufactured. For example, Idessa worked on the plans for an automated shop for a small company that makes differential ring gears. The scale model was introduced last November at the Special Machine Show in Rouen. "Our client wanted to tailor his production to demand (shorter production runs), cut down fabrication times, and keep up with growth of his product in the years ahead," added Michel Martin, who heads the counselling department.

By using very simple mechanical devices (bins for buffer-stocks, automatic loading stations, supply bins running on track laid in the floor) and moving some of the machinery to more convenient positions, the owners are buying better flow management. A 16-bit mini-computer is all it takes to run the whole plant.

"According to our calculations, production delays will drop from 3 weeks to 20 hours for a 3,000-piece batch, while costs of materials for further processing will be down by a spectacular 90 percent, and the payroll gains this will produce will total 48 people out of three shifts."

Jean-Pierre Vignaud (technical directorate, Renault Machines-Outils) agrees that this is what's happening: "We have quite a lot of projects like that where we are involved primarily as suppliers of conveyor equipment. It is a major approach that will affect all PMEs." Paul May, board chairman of CECN Industrie, is emphatic about it: "It's anyway 4 or 5 months that people have been asking us for this kind of automated plant."

The first of them will be in operation very shortly. "That's why CECN Industrie, which has already developed unit-management software, is already at work on a flexible production line for sheet steel, including unrolling, cutting the sheet with lasers, punching, shearing, and rolling -- and this is for a PME with only 120 people on its payroll. The plant should be operational in October 1983, and it will carry a price-tag of 700 to 800,000 francs."

Negotiations are under way for more plants, including some for a number of machining units. "We'll be showing this kind of plant at the World Machine-Tool Show in Paris, next June."

80-man PME Sets World First

Our final example comes from Automatique Industrielle SA, which is building, among other projects, Citroën's flexible shop at Meudon: "We are going to design, for a PME in the Lyon region, SAPIAC, an automated machining shop that will be the complete opposite of Meudon," says Patrick Jourden, project manager. "It will be a fairly inflexible shop producing automobile parts, but it will be highly automated." Slated to start up at the end of

this year, the shop will consist of 20 digitally controlled machining stations, two robots, two washing machines, and two metering machines, supplied by 10 or so tolley-powered supply bins. A mini-computer will handle despatching supply bins to machines; and the shop foreman will use a ballpoint pen to write out pay orders. "Careful, though! This will not be a shop without people: it will be a shop where machines will take care of bringing supplies to the machines." A computer simulation shows that the "machine-hours" of operation would rise by 90 to 95 percent, that response-to-client time would drop from 15 days to 2 days, and that raw stocks on hand awaiting processing would drop from 7,500 to 1,500 pieces. Says Jourden: "So far as we know, this will be the first automated shop in the world run by a company with only 80 people on its payroll."

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SURVEY OF STATE-OF-THE-ART WELDING IN FRANCE

Paris L'USINE NOUVELLE in French 24 Feb 83 pp 83-85

[Article by Daniel Coue: Laser Welding Moves into the Plant"]

> [Text] Laser welding has come out of the lab. Some ten such machines are doing their thing in French industry. Aircraft parts, measuring devices, medical equipment, electrical and mechanical components... (and, any day now, automobiles and household appliances) are putting the new process to good use, and finding out about its advantages, including pinpoint concentration of energy and a natural aptitude for automation.

Welders now have yet another variant to add to their already wide range of process options: laser welding. Just in the last few months, new applications at Industria, CII-Honeywell-Bull, Thomson, Aérospatiale and SFIM, as well as imminent plans among the automakers, show that laser welding has come of age in industry.

Of about 35 laser machines used in welding, a little over 20 are designed for industrial use. Among them about ten are operating on mass-production lines, where they are used only for welding. Currently, it is the sturdy YAG (for yttrium, aluminum, and garnet) that has the spotlight, since the power levels involved seldom exceed 300 to 400 Watts. There is, however, at least one exception: at the Ferté-Saint-Aubin plant of Thomson-Brandt, they are using a Spectra Physics 2.5-kw CO_2 source to weld very thick-walled stainless steel tubes. Applications are confined, however, to the high-tech sectors: nuclear, aviation, measuring devices, medical apparatus, and electronics. Even so, such areas as high-speed printing and electronics are beginning to open up. That trend may well be spreading fairly soon to household appliances, sensors, small-scale mechanics, boilermaking, and sheet steel... The spread would in many cases be a fait accompli by now if firms had not delayed investments in the climate of recession.

Ink-Cartridges to Bus Shelters

True, when you look at it next to such familiar applications of power lasers as découpage and surface heat-treatment, welding dwindles to near insignificance. In France, particularly. where competing welding techniques such as microplasma or electron beam were developed quite early on, and have long held the high ground. Even in the United States, where laser welding aroused more interest, its development was fairly stagnant for quite some time. You will recall the disappointments they experienced at Ford, where they tried as early as 1972 to use laser for body welding on the assembly line. As it turned out, the plant design was over-scaled. Four different welding areas were fed by the same CO_2 laser source, which led to problems with optical control of the beam. Furthermore, problems of faulty fit when body parts were attached began to surface. And apparently there was also some question as to the reliability of the source. Claude Kluzinski, who heads the Laser division of the Welding Institute makes no bones about it: "It's not enough to know how to produce a laser beam: you've got to know how to weld! And you have to follow the rules to the letter, and I mean the rules for making a high-quality weld: preparation and relative pre-positioning must be extremely accurate when the parts are clamped into place, and you have to keep a very sharp eye on all your parameters."

Today American industry people have got over their wariness and learned some lessons from those mortifying early setbacks. Aside from aviation and space, laser welding is used for jobs as disparate as sealing the ink cartridges for Parker pens (after they are filled), putting together aluminum double-glazed window-frames, sealing pressure gauges, fastening the trim on refrigerator doors... and even welding the panels and roofs for bus-shelters!

In France, no question but that the plant brought on line a year ago on SNIAS' Mureaux facility to weld large-scale sandwich panels ("Norsial" type) is the one that has aroused the keenest interest. "This application shows French and European industry that lasers can solder other things than microrelays or pacemakers," says Alain Gatinel, who heads Laser Optronic, the French representative of Britain's JK Laser, which designed and built the big machine. The panels consist of flat sheets housing corrugated cores, which are spot-welded along the points of contact.

Developed -- starting in 1970 -- to make the inter-stage skirts for the Europa launcher, Norsial panels have been used for hoods on Transalls and tail-assemblies on missiles. From the beginning, they have been made of thin stainless steel plate (0.3 mm for the flat plates and 0.15 mm for the corrugated). And this is what made resistance welding possible. "This process, though, entailed fairly heavy fabrication costs says Jacques Haroutel, a specialist in welding problems at SNIAS. It's a pretty heavy techhology

to set up, one that demands the utmost precision and requires copper tools that are complicated, delicate, and hence very costly."

In 1975, when they were considering turning to Norsial for the design of the air intakes for a new tactical missile, resistance welding turned out to be wholly unsuited for the purpose, because of the thicknesses involved: 0.32 mm for the corrugated and 0.6 mm for the "skins." The problem was to produce panels measuring 1,250 mm long, 500 mm wide, and 8.7 mm thick overall (standard corrugated is 11 mm thick) from cold-rolled Z 12 CN 18.8 steel. Tests showed incompatibilities in tuning parameters which could generate high levels of rejects. The "Norsial solution" was the only one feasible. In order to get equivalent strength, they would have had to use massive sheets of 16 CD V 6 tempered steel 8 mm thick! Furthermore, the operating temperatures (350°C on a continual basis) foreclosed any notions about using composites.

That meant looking for another assembly mode. Brazing was discarded because it tended to draw down the cold-roll temper. They turned then to welding techniques using a highly concentrated form of energy so as to limit reheating and distortion insofar as possible. Final tests were run using electron beams as well as YAG and CO_2 laser. In the event, the electron beam was quickly discarded because of its lack of flexibility (a vaccuum problem!) and its price. "In the end, we opted for the YAG, because its penetration never exceeds 1 mm. The power requirements are therefor moderate," explains Jacques Haroutel. For this kind of job, the YAG laser seemed slightly more reliable and more economical."

The machine, delivered in January 1982, has a 300-watt pulse laser source, a criss-cross table, a control system with CNC (Posidata 1800) and a video circuit. All welding parameters, all source parameters, all relative parts displacements of parts and beam, and all (argon) gas protection is taken into account in programming. The investment came to around 1.5 million francs, 400,000 of which went for the source.

Each panel requires 225 welds, each comprising 70 spots. What it involves actually is little seams, 2 to 2.5 mm in length, made with eight successive pulses each. The most satisfactory welds were made with a firing frequency of 12 Hz with a pulse energy of 10 to 11 joules. Welding speed runs as high as 220 mm/mn (the space between pulse series is covered in fast forward). The plates are trued up and kept in contact in a clamp-frame that allows indexation of the wave positions. In order to insure perfect smootheness, the weld must be made every 44 mm (one line out of four), with eight successive turns and passes. Results thus far confirm early findings of the laser's excellent ability to duplicate performance. The considerable cost reduction in fabrication owes as much to the process itself as to its suitability to automation.

Capacity to Handle Large-Scale Assemblies

By comparison with conventional methods, laser welding also eliminates all need for mechanical contact between the source and the parts. In so doing, it cuts down on deformation and flaws in relative position, and does away with electrode wear. Compared with electron bombardment welding, which is limited by the dimensions of the vacuum chambers available, it affords a capacity to handle very large assemblies. SNIAS will exploit this flexibility in its manufacture of inter-stage skirtings and engine supports for future generations of the Ariane.

This is also an advantage which boilermakers and sheet-metal rollers are not likely to overlook in the future. One pertinent indication of that is that the automakers are actively engaged in body-welding studies. "When we look around at the sources currently available on the market and the constraints placed on us by the pace of mass production operations, we think we can use [laser] machines with up to 1.5 kilowatts of power," says Jean-Louis Ghiglione, one of the men who run the laser test facility at the Renault plant in Meudon. "That would give us penetration on the order of 2 mm." Even so, when it comes to body work, the use of laser welding will require considerable tightening of the tolerances in sheet-steel fabrication. "We have shown that match defects must not exceed 15 percent of the thickness of the thinnest part," adds Ghiglione. "That will call for some extensive changes in shaping processes!"

To overcome any persistent doubts, laser welding will have to show it can do the job of assembling machine parts. In this field, plans are more advanced. Renault expects to have two production-line machines equipped with laser CO_2 sources and powered at 900 and 1200 watts, to be used in welding stainless steel to steel and steel to steel. Another milestone: the French firm of Sciaky a few months ago delivered a testing system equipped with a BOC (CO_2) 2-kw source to Germany's Daimler-Benz. It has a CNC Allen Bradley system 7320 which controls the entire cycle, including the movement of parts and beam, provided by a four-axis system. In welding, this installation can reportedly achieve penetration to a depth of 3 mm at a rate of 1 meter per minute.

The extreme thinness of the line affected by the heat is also an often cited advantage of this technique. One of the bonuses is very low heating of parts and environment. With YAG sources, since the impulse intervals and setting times are very short, the welded assembly remains almost at ambient temperature. This was, for example, a cogent factor in the decision by SFIM (French Measuring Instruments Company) at Massy-Palaiseau to select the process for hermetically sealing its gyroscopes. The competing plasma weld process would have affected the geometry of the mechanical parts and might degrade the electronic components sealed into the device.

The Lasag/Optilas, installed about 7 months ago, is now in the transition period to assembly-line operation. It includes a 150-watt pulsed laser head and an X Y coordinates table, all of it run by a CBM computer. The weld to be made here is a bastard weld done by a coating process, and yielding very high levels of helium-tightness (10^{-8} atm.- cm^3/s).

Bernard Radier, CEO at Stemp, a small company (110 employees) active in sub-contracting, design and construction in sheet steel, sees the main advantage of laser welding over plasma and TIG arc processes in its perfect repeatability record in all tests and the excellent appearance of the welds obtained.

Environment and Safety: Shadows on the Screen

The company has also been using a 1200-watt Photon/Laser Technique CO_2 laser, which it uses in decoupage at the record rate of 16 hours per day! Some development in the welding area is contemplated during 1983. "That's provided we buy another machine," says Radier. A four-axis installation is in the completion stages, and preliminary tests run, for example, on a large-dimension wave-guide, have been conclusive.

None of this means, though, that we should expect a dazzling breakthrough for laser welding, if only because it is suitable only for non-reflecting materials. In industrial use, aluminum welding is still problematical, and copper has been almost entirely ruled out. There are still complaints about its low yield and its exceptionally heavy space requirements. Furthermore, it is highly sensitive to the environment: a laser is, first of all, a delicate optical instrument that does not like vibrations! One more shadow on the screen: safety. With CO_2 sources, whose emissions fall into the middle of the infrared range, extremely powerful screens are required, but they can be made of conventional materials such as plexiglass. The YAG laser, though, whose emission wavelength is ten times shorter (1.06 μm), is considerably more dangerous and demands encapsulation of the welding zone or complete shielding of the machine -- or even housing it in a shop of its own.

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BRIEFS

'MIDI ROBOTS' FORMED--Some of industry's top society has gathered around the cradle of Midi Robots, soon to be born in Toulouse: the CNRS [National Center for Scientific Research] (28 percent); ONERA [National Office of Aerospace Studies and Research] (23 percent); Matra (17 Percent); Sesa (11 percent), as well as three financial organizations (21 percent). The new company is getting off to a start in life with capital of 7 million francs. Its areas of interest are: robotics, automation systems, and artificial intelligence. Eventually, Midi Robots hopes to offer a catalogue of hardware and software in the following areas: vision systems, machine and robot control systems, and flexible workshops. It also wants to offer "expert systems," derived from its experience with artificial intelligence. The creation of Midi Robots is one of the priorities of the industrial policy established by the French government. Toulouse is, of course, one of the major French centers of robotics. [Text] [Paris LE NOUVEL ECONOMISTE in French 13 Jun 83 p 41] 7679

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